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Regenstrief Center for **Healthcare Engineering**

A Strategic 6-Year Roadmap for the Regenstrief Center for Healthcare Engineering (2017-2023)

Board Report

June 2017

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RCHE Foundation Board Report June 2017

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The Regenstrief Center for Healthcare Engineering

Introduction

Several important changes in healthcare have occurred in recent years. These include:

- a focus on personalized and coordinated care,
- a desire to implement evidence-based practices,
- the implementation of outcomes-based financial incentives,
- the use of multiple modes for delivery and patient interaction, and
- a broadening of efforts to improve and maintain health and wellness.

Despite many positive changes, several challenges remain. The cost of healthcare is a significant burden for much of the US population. Further, many individuals, including a large proportion of those covered by Medicaid or living in rural areas, have either no access to primary care or have to travel significantly farther than their privately insured counterparts. Despite countless publications and national health goals aimed at their reduction, disparities in health outcomes by race/ethnicity, gender, and geographic location persist. Furthermore, healthcare as an industry lags behind other industries (manufacturing, logistics, software technologies, finance) in its ability to deal with complexity.

For the state of Indiana, most community-based measures are well below average when compared to other US states. In 2015, the Commonwealth Fund Scorecard on Local Health System Performance [1] reported that no county in Indiana ranked above the fourth quintile in overall score. Further, among the 50 states and the District of Columbia, Indiana ranked 43rd. Specific areas in which Indiana performed below the national average included access (34th), prevention and treatment (34th), avoidable hospital use and costs (36th), healthy lives (42nd), and equity (47th) [2]. The Robert Wood Johnson Foundation found that although Indiana ranks above the national average in providing clinical care (e.g., insured population, ratio of primary care physicians, dentist, and mental health providers to population) it ranks below average in health outcomes (e.g., premature death, poor or fair health). [3] At the national level, as discussed in the 2016 Regenstrief Center for Healthcare Engineering (RCHE) Strategic Forum, “Americans have fallen behind citizens of other developed economies on several important health indicators. The high resource costs of the healthcare sector, combined with its relatively poor productivity, suggest that engineering, science, and management solutions must be brought to bear. It is imperative that healthcare become better, faster, safer, and cheaper” [4].

The Institutes of Medicine reported that even though “...vast computational power is increasingly affordable and widely available, and connectivity allows information to be accessed in real time virtually anywhere by professionals and patients, permitting unprecedented diffusion of information cheaply, quickly, and on demand,” they are not always put to good use in practice (Figure 1) [5]. In order to realize the full potential of these advances, a health system must be reconfigured to support improvement and learning.



Figure 1. Missed opportunities, waste, and harm in healthcare [5].

RCHE is well positioned to address many of these challenges to improve outcomes and efficiency, first for the population in Indiana, and then more broadly for US and global populations. In this document, we:

- 1) identify strategic areas where RCHE can have the most impact based on our strengths, the importance of the area, and current and potential collaborations with partners;
- 2) specify our six-year goals (2017-2023) to address these priorities; and
- 3) describe our action plan for the upcoming year.

The Strategic Forum on Reengineering Healthcare Delivery [4] held by RCHE in 2016 provides the foundation for this document.

Mission, Vision, and Core Values

The establishment of RCHE in 2005 was made possible by the support of the Regenstrief Foundation, whose founder, Sam Regenstrief, had a strong interest in increasing both the efficiency and equity of healthcare delivery. Our methods to accomplish Sam’s vision for improved healthcare delivery are grounded in the disciplines of engineering, service science, and implementation science.

Healthcare engineering views health care as a set of complex systems and applies and innovates engineering design and analysis principles to these systems in order to improve the patient experience, reduce costs,

and improve population health outcomes. *Service science* is an interdisciplinary approach to the study, design, and implementation of specific arrangements of people and technologies that take actions that provide value for others. Service may be thought of as a provider and a client (e.g., doctor and patient) working together to create value. An

important distinction is that whereas engineering systems typically examine the relationship between people and technology, service systems

examine the relationship between people and other people. As a result, service systems introduce dynamics that can be difficult to predict. Finally, *implementation science* is the study of methods that influence the integration of evidence-based interventions into practice, such as provider or patient adoption of new methods and technologies. The dissemination of knowledge to healthcare settings is an important component of implementation science. Note that RCHE's focus on healthcare delivery is not just the processes that occur within a hospital or other specific delivery setting, but rather the interactions with healthcare providers, employers, community organizations, and state, federal, and international health departments.

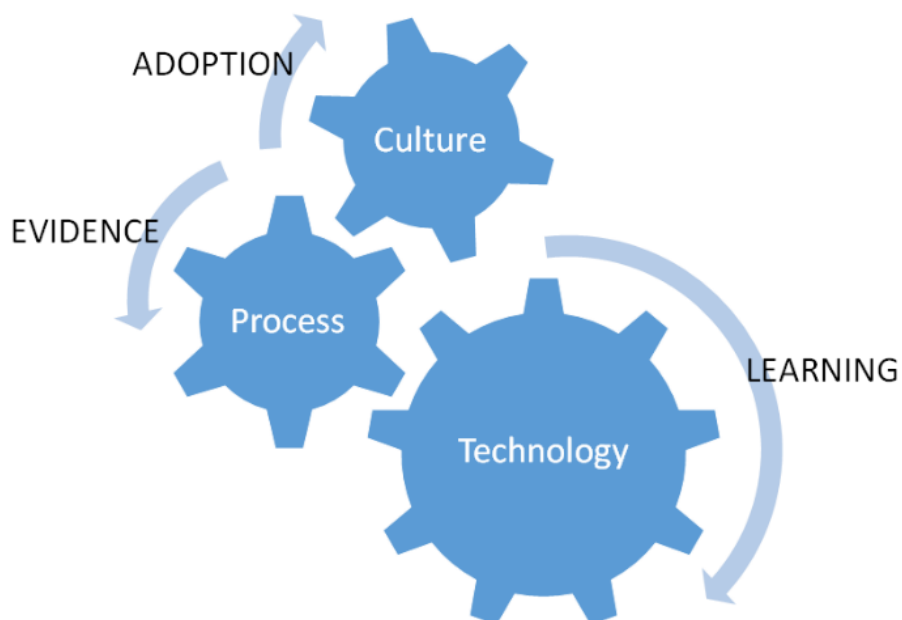


Figure 2. Strategic focus areas would be addressed with a multidisciplinary approach.

Our mission is to:

Pursue a transformed healthcare delivery system by conducting impactful research guided by national priorities and leveraging collaborative partnerships.

Our vision is:

To be a leading research institution that generates evidence for the effectiveness and successful adaptation of interventions/policies to improve the quality, accessibility, equity, and affordability of healthcare delivery.

Our core values are:

- *Community* - Sustain an inclusive and diverse environment that promotes collaboration and scholarship on challenging issues in healthcare delivery;

- *Accountability* - Be diligent stewards of the trust, funds, and data of our supporters and partners
- *Integrity* - Be honest and ethical in our actions;
- *Effectiveness* - Deliver impactful, healthcare delivery research demonstrated through measureable outcomes.

Strategic Areas, Goals, and One-Year Action Plan

In this section, we present three strategic priorities on which RCHE will focus its collective efforts over the next six years. In addition, we define our two key goals for 2017 to 2023 and a one-year action plan to establish the requisite foundation to achieve these goals.

RCHE will emphasize a collaborative process in its research and outreach that includes faculty, students, and staff from a variety of areas (Figure 2). To be successful, we must consider not just the healthcare delivery process (i.e., workflow), but also the supporting technology and the underlying culture of the organization. Our work will support a *learning* environment that generates and applies the best *evidence* for system decisions on health and wellness while considering the organizational changes necessary for its successful *adoption*. Based on RCHE's mission, our research process will proceed through the following phases to maximize impact (Figure 3).

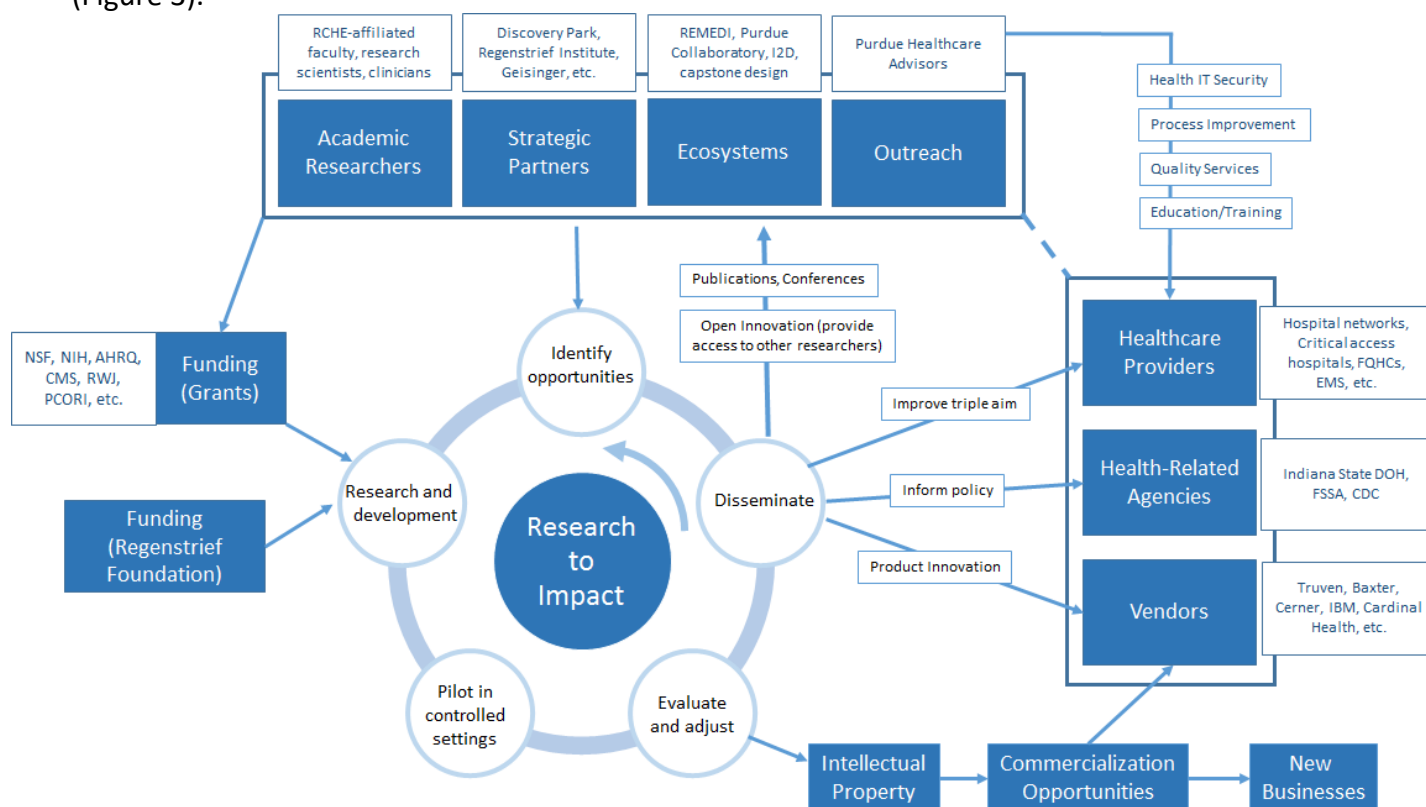


Figure 3. Research to impact phases.

One critical advantage that RCHE possesses over its competitors (e.g., John Hopkins University Malone Center for Engineering in Healthcare, University of Michigan's Center for Healthcare Engineering & Patient Safety, Northwestern University's Center for Engineering and Health, and University of Wisconsin's Center for Health Systems Research & Analysis) is the presence of a significant outreach arm; namely, Purdue Healthcare Advisors (PHA). Appendix A provides a brief description of PHA's recent impact.

PHA consults, trains, and coaches over 150 hospitals and 100 health departments across the US. This provides RCHE's research arm with a mechanism to evaluate the implementation of its findings among PHA clients along with critical information on factors (e.g., organization environment, incentives) required for successful adoption of research findings in the healthcare sector. This knowledge will increase the impact and reach of RCHE research. Further, by partnering with PHA staff, academic faculty and research scientists gain critical access to providers and agencies, which in turn provides researchers with better insight and understanding of the key problems/challenges confronting healthcare delivery. In addition, RCHE's research can open new opportunities for PHA to pursue. RCHE will continue to facilitate this collaboration between faculty/ scientists/students and PHA staff. A key challenge to sustaining this relationship, however, is the large difference in time required to conduct research versus time to successfully implement findings in the healthcare sector (Figure 4).

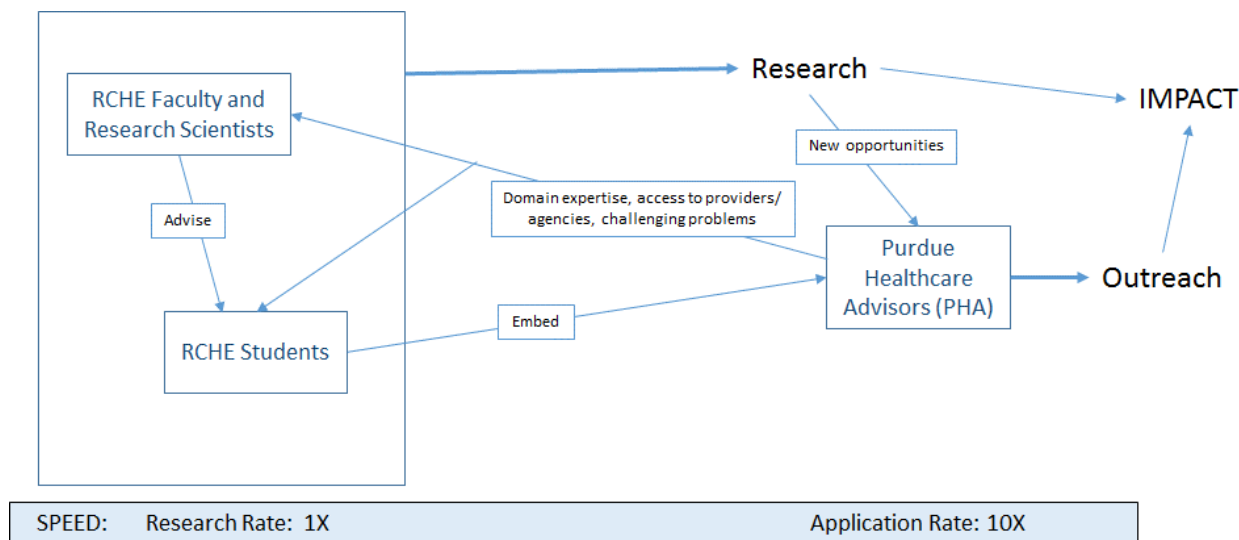


Figure 4. Integration of RCHE Faculty and Scientists with PHA.

Strategic Areas

In order to best leverage the resources available with the specific strengths of RCHE-affiliated staff, scientists, and faculty, we will focus on three strategic areas over the next six years. Because we expect these areas to evolve as we hire new faculty, they are currently described in broad terms. The three strategic areas will be:

Focus 1: Supplementing evidence-based practice with evidence obtained from linking observations process data to outcomes

Clinical and operational decisions should be based on the best available evidence, although this may depend on patient and context characteristics as well as judgement of the clinician. As the ability to collect and process large amounts of digital data continues to expand rapidly, it is becoming possible for healthcare organizations to develop an evidence base that links process activities to patient outcomes. By not considering the large amount of data and physician knowledge residing in these systems, the current healthcare system is essentially throwing hard won data and knowledge into the bin.

To successfully address this challenge, it is important to develop readily accessible databases, visualization of data, sensors, and situational awareness into a structure that provides actionable information – bridging the gap between data and evidence generation for clinical knowledge. It also requires that process characteristics such as data from infusion pumps, bedside monitors, or real-time location tracking systems be linked to the electronic health record (EHR) and patient reported outcomes (PRO) to have a holistic view of the patient care delivery process and outcomes, rather than looking at data residing in different systems in silos. Many organizations are mining the EHR based on patient factors in order to make advances in personalized care or predictive analytics. Few have successfully tied processes to outcomes.

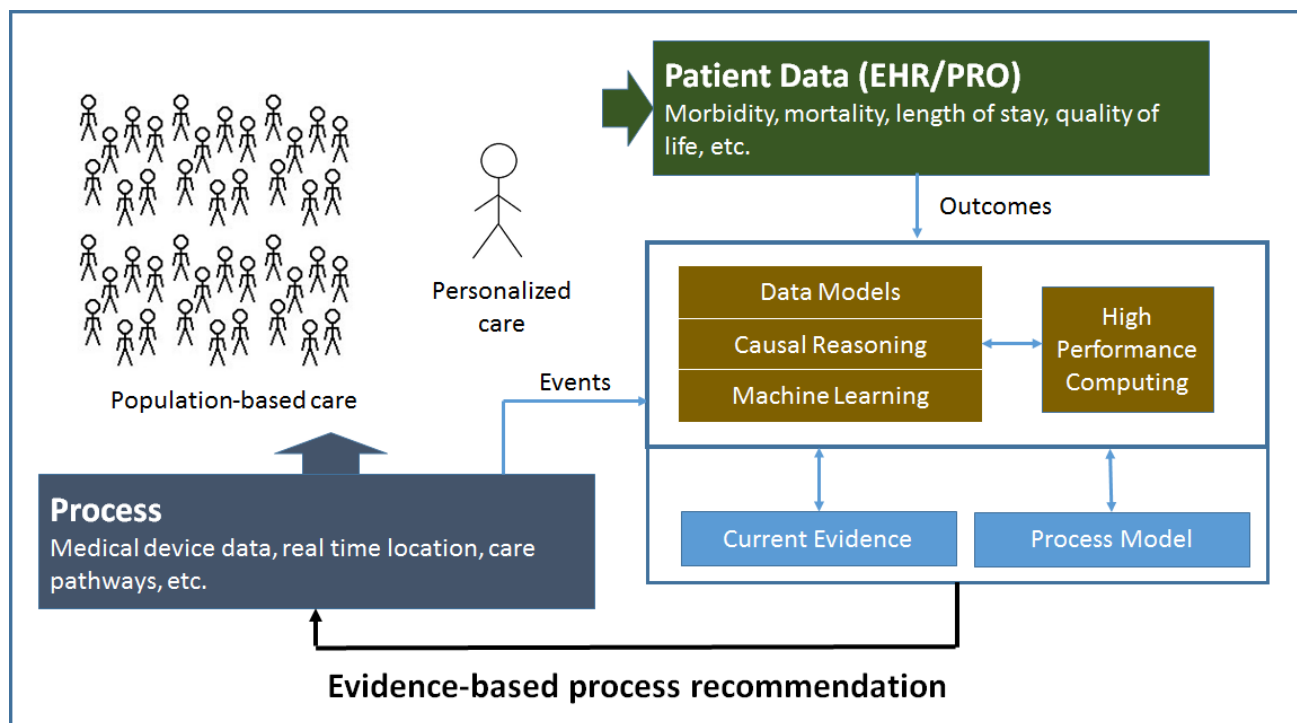


Figure 5. Linking of process and outcomes data.

Built on the success of Regenstrief Center for Medical Device Informatics (REMEDI), RCHE has both a unique set of process data and a well-used collaborative platform for providers to send information. Appendix B has a brief description of REMEDI's recent accomplishments. RCHE is therefore well positioned to build the evidence for more effective and efficient delivery of care based on processes associated with medical devices. To be successful, RCHE will need to build additional collaborations with 1) data science with special emphasis on addressing the limitations and strengths of using causal (or association) inference analysis from observational data compared to the current gold standard, randomized controlled trials and 2) device users such as a pharmacy and medical experts to provide domain knowledge and meaningful context. This is illustrated in Figure 5. Note that RCHE already has strength in working with large data sets; de-identifying data; properly housing, securing and managing that data; and supporting searches in big and wide data.

Illustrative Examples:

- **Personalized medical device settings** – smart pumps are infusion pumps equipped with IV medication error prevention software. By linking smart pump data with patient data from the EHR, it is possible to improve evidence-based decision making. For example, hospital clinicians can measure the impact of pump library compliance on patient safety and test whether the assumption that higher use of pump library compliance improves patient outcomes (e.g., shorter length of stay). In addition, machine learning and statistical methods may be developed and applied to “personalize” medical device settings such as infusion limits based on specific patient characteristics.
- **Process mining through real time location systems (RTLS)** – radio frequency ID (RFID) tags are being employed in many hospital systems to track patients, healthcare workers and equipment. Information from RTLS can be matched with clinical data to study the impact of

various types of interactions such as patient-physician and nurse-nurse meetings, particularly in care transitions. This also allows various process factors (e.g., handwashing compliance, identification of bottleneck locations/operations) to be studied and tied to specific outcomes, including hospital acquired infections. Process mining techniques can further be used to study patient care over time in order to determine the most effective pathways of care in order to drive process improvements and improved patient and provider outcomes.

Focus 2: Supporting an adaptive healthcare continuum by effectively matching resources with demand.

Healthcare organizations often “sub-optimize” their delivery by focusing improvement efforts on a particular component of their system without properly considering the complex set of interactions with other system components. Demand on the system is typically highly variable, uncertain, and out of the direct control of the provider (Figure 6). Relying on methods such as demand forecasting without accounting for process adaptability can lead to poor performance. Furthermore, each contributing entity in the system can be influenced by “perverse incentives” that undermine the effectiveness and efficiency of the health continuum. Misaligned incentives can result from ill-designed reimbursement structures for care providers, undue focus on the affordability of medications, and a system focused on treating the sick rather than maintaining health. As healthcare has moved from a fee-for-service to capitated model, controlling costs has become one of the most important drivers in the industry.

RCHE staff and affiliated faculty, and in particular PHA, have a history of successfully improving healthcare through lean implementation. Furthermore, RCHE has excellent connections with various delivery sites and state agencies. Properly matching resources (capacity) with demand will be an essential problem for RCHE to address. Success will require an interdisciplinary approach that brings expertise from nursing, organizational behavior, industrial engineering, service science, health economics, statistics, and computer science. As the healthcare environment is at best uncertain, and since costs have become such an important driver, this area should grow in importance.

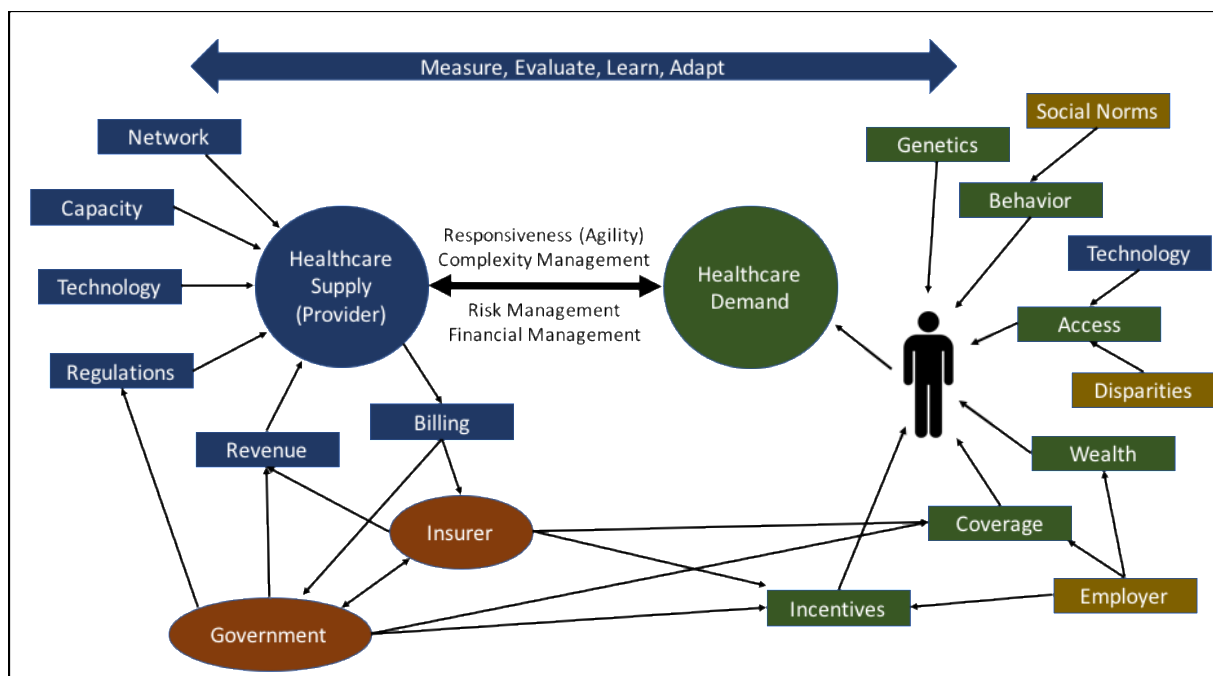


Figure 6. Relationship between healthcare resources (supply) and demand.

Illustrative Examples:

- A systems approach to mitigating opioid abuse in Indiana – In an effort to address the growth of opioid abuse, Indiana has initiated programs such as prescription drug monitoring (INSPECT) and drug courts. A key challenge for Indiana is not only the limited supply of needed services such as workforce for various programs, but also the mismatch between available supply and need for those services at various program locations [7]. To address this issue Indiana can:
 - i) make process improvements at points of service including capacity management and workforce development,
 - ii) identify locations with greatest need and expand points of service in these areas,
 - iii) support and foster community collaboration and action, and
 - iv) make optimal use of existing resources through early identification of high risk patients, risk stratification, providing evidence-based interventions at the best point-of-service, and tracking effectiveness.
- Managing non-acute care at Eskenazi¹ – Eskenazi is considering fundamentally changing how non-acute hospital care is managed and delivered for high-intensity patients via a new service delivery organization, which will include expanded resources (e.g., community workers and EMS), coordination of care management programs (spanning acute and non-acute care settings), and use of technology (telehealth, etc.). Currently, Eskenazi has 14 independent care management teams spanning care at 38 unique outpatient clinics, creating challenges with overlapping services. This presents an opportunity to create a

¹ It should be re-emphasized that this is only an example, and not a current research project being performed by RCHE. The concept is being discussed with multiple providers, including Eskenazi.

systems approach to deliver these services with better outcomes and fewer resources. This new system would need to address several challenges including organizational alignment, clinical design and oversight, and delivery system design (such as logistics, resource planning/deployment, and decision support integration to name a few).

Focus 3: Improving health and wellness in the rural community

About 10% of the variability in health outcomes is attributable to healthcare [6]. Behavioral and social factors, along with genetic predisposition are major determinants of health and wellness. Moreover, in order to make interventions more coordinated, tailored, timely and continuous, there will be a shift to more virtual care with less dependence on clinical care solutions. Development of systems that will improve health in communities, in particular rural ones, must consider other determining factors. It is anticipated that this shift will result in additional consumer engagement. At the same time, however, many individuals have little or no access to healthcare and support services. Rural populations, in particular, rank poorly in most health indicators compared to their urban counterparts [8]. In addition, a recent study found that over 650 rural hospitals are vulnerable to closure in 42 states and that 38% of Critical Access Hospitals are operating at a financial loss [9].

According to the Robert Wood Johnson Foundation, developing a “culture of health” in the community requires:

- i) making health a shared value across members of the community,
- ii) fostering cross-sector collaboration between partners in health and non-health areas,
- iii) creating healthier, more equitable communities, and
- iv) strengthening integration of health services and systems [10,11,12].

Successful strategies developed in other settings such as large teaching hospitals are not always directly translatable to rural settings (Figure 7).

RCHE can help to improve the health and wellness in rural communities by identifying opportunities (e.g., “at risk” populations), determining how to best target interventions, characterizing spread of a condition through a community, fostering technology adaption and the appropriate use of eHealth, mHealth, and telehealth. RCHE can also help to determine the best application of point of use and assistive technologies, and determine how to integrate them into the healthcare system. Further, RCHE can help to inform policy makers (e.g., state and federal agencies) in community-based decisions. Helping the state to coordinate activities for the opioid crisis, would be one such example. To be successful, we will need to continue to develop better partnerships with state and federal public health agencies. Further, it will be important for RCHE to obtain access to community-based data such as claims at the individual level, and will require faculty across a broad range of areas including nursing, human development & family studies, communications, and biomedical engineering. Finally, since a primary determinant of an individual’s health and wellness is behavioral (the foods they choose to eat, the likelihood of following a physician’s advice, etc.), it will be important to work with faculty from areas such as behavioral psychology in order to ultimately make a significant impact. Note that PHA works closely with many communities in Indiana and the Purdue School of Nursing runs four family health clinics in rural settings to improve

access to care for individuals living in those regions.

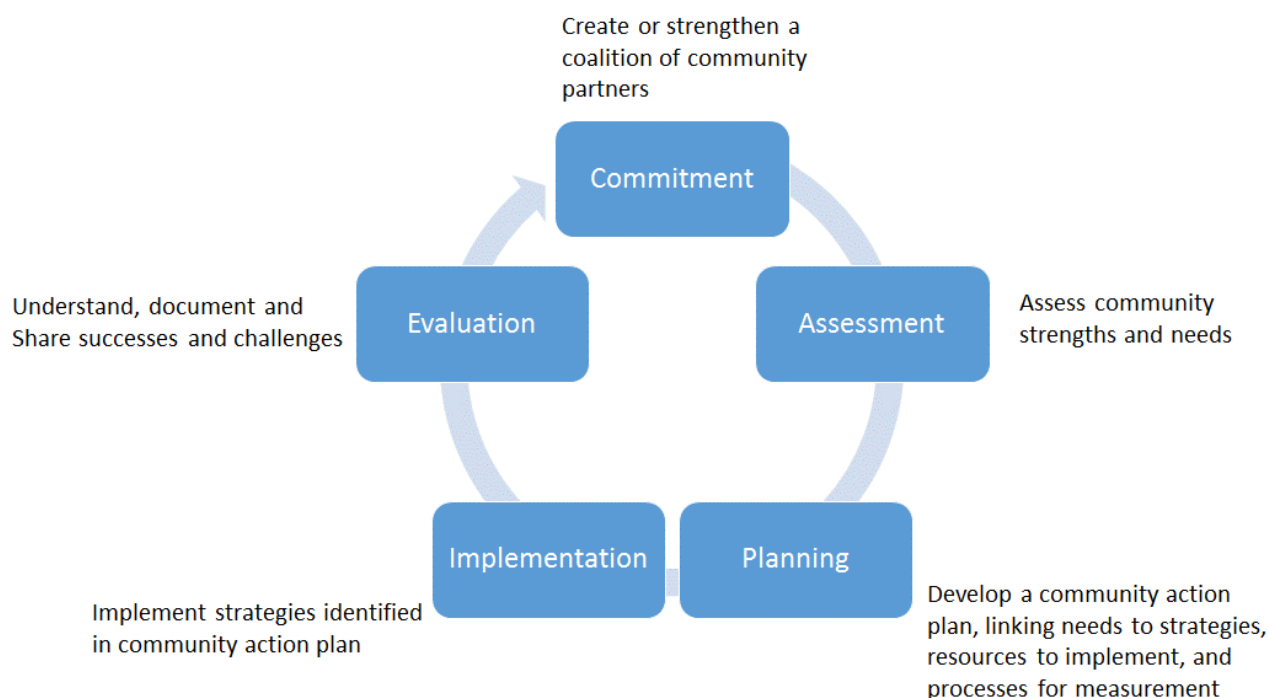


Figure 7. Improving rural health through community collaboration [13].

Illustrative Examples:

- The development and integration of remote point-of-care diagnostics and monitoring*

Distance and lack of healthcare infrastructure negatively impact care to underserved (e.g., rural) communities. Significant advances have been made in new sensor and device technologies that allows for the inexpensive monitoring of vital signs and diagnosis of conditions in these areas. Examples developed by Purdue faculty include a low-cost paper-based test for neonatal sepsis, a non-invasive phone-based imaging system to monitor hemoglobin levels for anemia identification in pregnant women, and a non-invasive test for glucose monitoring in saliva and tears for diabetics. In addition to developing remote point of care technologies, it is important to determine how they can be integrated into the healthcare system. This includes consideration of appropriate reimbursement mechanisms, development of the supporting health information technology that is both reliable and secure, determining who should participate, patient/caregiver education and support, and developing strategies for improving proper adoption of point of care devices.
- Rural care coordination through telehealth and health portals*

As compared to their urban counterparts, rural areas face more hospital closures, physician shortages, and higher uninsured rates. It has been demonstrated that telehealth can be an effective strategy to help address these, but faces many challenges. These include financial sustainability since payers such as Medicare do not recognize the home as an originating

site of care for reimbursement, the development of an effective care team to support the technology, integration with remote monitoring, and licensing and jurisdictional issues. Developing and implementing the most appropriate telehealth system coordinated with other approaches such as home visits and rural clinics requires research advances in policy, workforce development, technology development and adoption, and economic/financial considerations. RCHE can also develop a mechanism for rural community empowerment through a collaborative portal using Purdue's HUBzero platform.

Goals

RCHE will continue to invest in and support its key programs such as REMEDI and PHA as well as its research scientists and other staff members. In order to significantly advance RCHE's impact in the strategic areas defined above, two key goals have been established for the 2017 to 2023 time horizon. These goals address obtaining the needed resources and establishing the necessary infrastructure to conduct meaningful research in the three prioritized areas.

1. ***Significantly increase faculty and student engagement*** – The ability of RCHE to successfully address our strategic areas is determined in large part by the success of the faculty and their students. It is therefore important to identify appropriate faculty and provide them opportunities to collaborate with other RCHE faculty, staff, and research scientists. Five significant efforts to accomplish this goal will be to:
 - a. Hire five RCHE-affiliated faculty – Purdue has made a commitment of five faculty that would be hired in the College of Engineering (COE) with the primary goal of advancing RCHE activities. We will work to fill these positions over the next two to three years. This will be done in collaboration with the appropriate schools in the COE. Note that the COE has approved the search for 2 faculty in 2017/2018 after which we will reassess the results and search for 2 to 3 additional faculty in 2018/2019. The final search will likely be completed in 2019/2020. An example recruiting advertisement for these positions is provided in Appendix C. Note that this ad will be revised after the formation of the associated faculty search committee.
 - b. Recruit Purdue Faculty and Clinical Associates – Establish the requirements and benefits of RCHE affiliation and actively solicit involvement of faculty and clinical associates. This would include the recruitment of Purdue tenure-track faculty, other research scientists in Discovery Park at Purdue, and faculty at the Regenstrief Institute.
 - c. Recruit Purdue Student/Resident Associates – Use an undergraduate and graduate RCHE Fellows program where students would be provided with a nominal fellowship and work with RCHE-affiliated faculty on guided research projects. We will also increase the use of RCHE-led capstone design projects for undergraduate students and provide internship opportunities for MS students (e.g., in the Health Systems Program). In addition, we will establish an informatics rotation opportunity for pharmacy and nursing residents. Since it is difficult to scale assistantships and

internships, we will use web technologies, crowdsourcing, human computation, and educational innovations (i.e., “studentsourcing”) to create reusable content with economic or social value using learning labor. This co-production approach generates learning outcomes and commercially viable content, concurrently in the same process.

- d. Develop Appropriate Educational Opportunities – Identify and develop unique educational programs, if appropriate. This could include a traditional offering that would need to be developed with the appropriate schools and departments such as a graduate program in health decision sciences or public health engineering as well as the development of a hybrid program that would involve training, consulting, and technology support. An example would be PHA working with the School of Nursing leadership and faculty to introduce lean six-sigma curriculum into the nursing program.
- e. Establish a review process for faculty funding – We will on occasion encourage faculty to apply for funding opportunities through RCHE on projects that directly align with our strategic areas. This would include requests for specific projects and competitive (e.g., “grand challenge”) proposals. The funding requests would be evaluated by a review team based on several factors including research novelty, potential impact, clarity of research plan, and level of engagement with RCHE activities.

2. ***Identify external funding opportunities in our strategic areas and increase our level of external support*** and exposure – In order to have the appropriate resources to engage in the proposed activities, RCHE will need to obtain significant external funding from agencies such as the Agency for Healthcare Research and Quality, Centers for Medicare and Medicaid Services, National Science Foundation, and the National Institutes for Health. Funding from peer-reviewed sources also has a positive impact on RCHE’s reputation. Funding from providers and state/federal agencies will also be sought. Seven significant efforts to accomplish this goal will be to:

- a. Actively identify and leverage proposal collaborators – RCHE staff will identify funding opportunities that match with our strategic interests and determine the staff or faculty lead and collaborators needed to work with that lead in order to be successful. In addition, RCHE will help recruit the collaborators and facilitate interactions among the team.
- b. Facilitate large grant proposal writing – RCHE will provide resources to help investigators in the development of proposals for large grants. This may include the use of incentive/support funds as needed and the coordination with Purdue resources for vetting and reviewing of proposals prior to submission.
- c. Increase our involvement with the Regenstrief Institute – we will work to identify with the Regenstrief Institute research opportunities that leverage each of our unique research capabilities. This will enable both of us to better address important issues and make a more significant impact than we would be able to accomplish individually. We will also work to establish data use agreements to facilitate the sharing of data between organizations.

- d. Use RCHE resources as a source of matching – RCHE will help in the success of the likelihood of proposals being funded by providing matching resources. An example would be in supporting interested research scientists as a form of matching funds in performing the research. An important component of this will be the resulting engagement between the faculty associated with the matching and RCHE.
- e. Increase engagement between PHA staff and RCHE-affiliated faculty and their students – We will work to identify opportunities that require both PHA staff and RCHE-affiliated faculty, and promote those efforts. The Eskenazi and opioid illustrations provided in focus 2 of the strategic areas would be good examples of that engagement. The benefit of this engagement is the direct research to impact that could be achieved. We will also work to increase the level of collaboration in training and education.
- f. Establish an External Advisory Board (EAB) – The EAB will be made up of well-established leaders from healthcare providers and community organizations. In addition to providing feedback on strategy, the EAB will also help to establish connections for funding opportunities.
- g. Communicate the accomplishments – We will develop and send appropriate communications such as press releases about RCHE accomplishments, leveraging Purdue communications and marketing. We will also consider if additional marketing (e.g., branding) would bring benefit to RCHE.

One-Year Action Plan (2017-2018)

To achieve the goals set in the previous section, specific tasks must be accomplished. We have therefore established a one-year action plan, which will be updated each June over the 6-year strategic horizon. Input from the External Advisory Board (which will be established) and the Faculty Leadership Team will be used to update the action plan. Over the next year (2017-2018), RCHE will engage in faculty and student recruitment, REMEDI and PHA engagement, external funding expansion, External Advisory Board establishment, and center success communications. In addition, if invited by the Regenstrief Foundation, RCHE will submit a renewal proposal in December 2017. Specific activities and associated goals for the one-year action plan are provided in Table 1.

Table 1. Activities. Timeline, and goals for one-year action plan.

	2017			2018		Goal
	Q2	Q3	Q4	Q1	Q2	
Faculty Recruitment						
Write specifications for RCHE faculty positions						Define 2 positions
Form faculty search committees (a) and conduct searches (b)		a	b	b	b	Hire 2 faculty
Define RCHE faculty affiliate requirements and recruit						12 Faculty Affiliates
Define RCHE faculty leadership guidelines/support and recruit						8 Faculty Leaders
Student Recruitment						
Develop RCHE Fellows program (a) and recruit (b)	a	b		b		5 RCHE Fellows
Engage undergraduate capstone design with RCHE efforts						4 Capstone Projects
REMEDI Engagement						
Pilot project matching REMEDI data and EHR						1 pilot project
Determine “value” of REMEDI and revenue model						Recommendation
Add REMEDI and PSO members						100+ REMEDI, 2 PSO
PHA Engagement						
Involve RCHE faculty in projects						3 faculty
Involve student interns from MS program						2 interns
External Advisory Board						
Identify and recruit members for External Advisory Board						7 members
Hold first External Advisory Board meeting						Hold meeting
RCHE Successes						
Overhaul webpage (a) and update brochure (b)		a	a,b	a	a	Implement changes
Invite speakers for distinguished seminar series						2 speakers
Plan for fall RCHE Forum and establish co-sponsor partnership						PPRI Co-sponsor
Hold fall RCHE Forum						Hold forum
Establish a process for press releases						Implement plan
Launch press releases of RCHE accomplishments						3 per quarter
Publish RCHE e-newsletter						Monthly
Funding						
Identify funding opportunities and submit proposals						8 proposals, \$3M
Support large grant initiative (> \$5M)						1 proposal
Develop pilot research opportunity with Regenstrief Institute that is externally funded						1 project
Management						
Establish an Internal Advisory Board for funding review						Implement plan
RCHE Renewal with Regenstrief Foundation						
Develop RCHE renewal proposal						
Present renewal proposal to the Regenstrief Foundation						December 2017
Strategic Planning						
Gather RCHE Faculty Leadership input for 2018-2019 action plan						
Evaluate metrics and update RCHE strategic plan						
Submit updated plan to Regenstrief Foundation for approval						June 2018

Abbreviation key:

MS – Professional master’s degree in Healthcare Engineering

PHA – Purdue Healthcare Advisors (<http://pha.purdue.edu>)

PSO – Patients safety organization (<https://pso.ahrq.gov>)

RCHE – Regenstrief Center for Healthcare Engineering

(<http://www.purdue.edu/discoverypark/rche/>)

REMEDI – Regenstrief National Center for Medical Device Informatics

(<https://catalyzecare.org/remedi>)

Metrics and Monitoring Success²

In order to measure how well RCHE is meeting our 6-year goals, we will use the following metrics:

- Number of RCHE faculty associates during past year
- Number of RCHE student associates during past year
- Number of peer-reviewed proposals submitted over the past year by RCHE faculty associates and research scientists
- Total dollars of RCHE-affiliated peer-reviewed proposals that were funded over past year
- Total dollars of RCHE-affiliated non-peer reviewed projects funded over past year
- External funding dollars used to support RCHE staff
- Number of papers published in peer-reviewed journals from RCHE-affiliated research
- Number of conference presentations from RCHE affiliated research
- Number of press releases posted by Purdue University News
- Number of relationships with Discovery Park Centers and Institutes measured in co-sponsored activities (seminars and/or forums), number of jointly funded research projects, and number of co-authored peer-reviewed publications
- Number of relationships with Regenstrief Institute measured in number of jointly funded research projects, and number of co-authored peer-reviewed publications
- Number of documented providers impacted by RCHE efforts (year first implemented)
- Amount of documented savings/revenue by providers as a result of RCHE efforts

Each quarter, the RCHE administration consisting of the Director, Associate Director, Strategic Collaboration Director, Director of Purdue Healthcare Advisors, and Managing Director of Operations will discuss the progress that RCHE has made in meeting its goals. If RCHE appears to not be making reasonable progress to meeting the goals, then it will be determined if corrective action needs to be taken or that the goal needs to be reassessed. An annual report and presentation will be made to both the EAB and Regenstrief Foundation to solicit their feedback.

² Note that some metrics have already been established by the Regenstrief Foundation. We will continue to collect and monitor those. The metrics listed here are tied to our specific goals in this 6-year plan.

Resulting Impact

Since its inception, the Regenstrief Center for Healthcare Engineering has conducted systems-based research and developed tools resulting from this research across a broad range of areas including efficiency, effectiveness, patient safety, quality, and security of the healthcare delivery system. New programs have also been established within RCHE including the Regenstrief National Center for Medical Device Informatics (REMEDI) and the Center on Poverty and Health Inequalities. Further, RCHE, through Purdue Healthcare Advisors, has directly helped numerous providers, clinicians, and state-affiliated programs in the of areas health information technology security, quality reporting, and lean improvement.

Many new and exciting opportunities exist for RCHE to help address. As mentioned previously, the current practice of healthcare delivery is still largely one where insights are poorly managed, evidence is poorly used, and experience is poorly captured, leading to missed opportunities, waste, and harm. Building on our previous successes and leveraging the world-class capabilities of Purdue faculty in engineering, health and human sciences, management, and science, we can help to start to transform this system through the successful completion of our 6-year goals into one that is less expensive, delivers more personalized care, uses agile evidence-based processes that learn and adapt, increases healthcare employee satisfaction, effectively engages with the patient to empower them to pursue improved health, while reducing the disparities of persons living in in rural areas.

As an organization, we believe that over the next six years we will be able to significantly increase the size and diversity of RCHE-affiliated faculty and students along with the external funding to support their activities. This will also allow us to generate the funds to increase the number of RCHE scientists. The increased engagement between RCHE faculty, scientists, and staff with PHA staff will significantly improve our research-to-impact process. Most importantly, our growth will allow us to better address healthcare delivery needs by having the capacity to consider more broadly the important issues in healthcare delivery that directly impacts the health and wellness of our population. Further, we will achieve our goal of preeminence in healthcare engineering research combined with transformative impact on healthcare delivery and community engagement for improving healthcare and wellness outcomes.

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Appendices

Appendix A

Purdue Healthcare Advisors

PURDUE HEALTHCARE ADVISORS

Purdue Healthcare Advisors works with healthcare organizations throughout Indiana and beyond to build their capacity for change. This is done through a variety of state- and federal-funding sources and fee-based projects, and has impacted more than 100 hospitals and 6,000 providers in our 12-year history. Services include:

- Health IT Security – Providing security risk assessments and various security testing, audits and training.
- Process Improvement – Building process and quality improvement capacity via our Lean First offerings.
- Quality Services – Assisting providers with Meaningful Use and the transition to value-based care.

Current State and Federally Funded Projects

In the first quarter of 2017, Purdue Healthcare Advisors (PHA), the dissemination arm of RCHE, secured funding to begin one large-scale initiative (the QPP Resource Center) and to continue another (the MU Help Desk). The funding for three of PHA's five grant awards comes from the Centers for Medicare & Medicaid Services (CMS), so it was high praise for PHA to be selected to present at the upcoming CMS Grand Rounds event. This event will stream live to representatives of all Practice Transformation Networks across the country on best practices.

The QPP Resource Center™: Solo & Small Practices

- PHA is one of 10 partners participating in the MACRA Provider Resource Network (M-PRN) led by Michigan-based Altarum Institute. In February, CMS awarded \$20M to 11 organizations including M-PRN to fund the first year of the newly created **QPP Resource Center™ of the Midwest**. CMS intends to invest up to \$100 million nationally for this five-year program
- This CMS funding targets clinicians who practice in small groups and who may practice in rural areas, Health Professional Shortage Areas (HPSA), or medically underserved areas. Through M-PRN, PHA will assist up to **6,000 additional clinicians** in Indiana as they prepare for and participate in the new Quality Payment Program (QPP). Recruitment is underway.
- The Center will offer remote, self-directed services that — while less robust than the hands-on approach offered through PHA's GLPTN — will help to guide clinicians as they select and report on appropriate quality and improvement measures. When the Center's web portal goes live this summer, clinicians will have access to up-to-date, accurate QPP-related information; remote resources like MIPScast™ (a tool to help predict MIPS scoring); and live chat.



Practice Transformation Network: Primary Care & Specialists Physicians

- The Great Lakes Practice Transformation Network's (GLPTN) PHA-managed Indiana Operations supports nearly 2,400 of the network's 15,000+ clinicians, with 1,000 having graduated out of the program in the past year (*see right for total demographics*).



- Following assessment of all participating organizations in Indiana, PHA developed action plans to guide clinician engagement; coordinated a statewide MA CRA conference in February that drew 200+ attendees; designed a **MIPS Calculator** in use by the entire network to address performance gaps; and implemented customized assistance for groups, including help with chronic and transitional care

Indiana Meaningful Use Assistance Program

- PHA will continue to guide eligible Indiana healthcare providers toward Meaningful Use (MU) with an additional \$3.6M federal matching grant awarded to the Indiana Family and Social Services Administration (FSSA) and Purdue University. This CMS funding allows PHA to continue the Indiana Medicaid Meaningful Use Assistance Program, or MU Help Desk, which provides assistance for up to 150 Indiana ambulatory organizations as they attest to the stages of MU.



Healthy Hearts in the Heartland (H3)

- H3 Practice Facilitators from PHA continue work with 47 Indiana practices to collect research data as well as to implement and evaluate quality improvement strategies for cardiovascular care. H3-participating practices are making small, yet significant changes to prevent heart disease and stroke. One practice in Northern Indiana made it easier for patients to get the support they need to quit smoking by incorporating the Indiana Tobacco Quitline's participant form into its EHR system. A handful of other practices agreed to run customized reports to target hypertensive patients "Hiding in Plain Sight" (or HIPS) and found several, including two patients sent directly to the ER.

Other Service Line Impacts

PHA's three service lines – Quality Services, Process Improvement, and Health IT Security – are serving the healthcare industry by developing new offerings and updating old ones. For the Process Improvement line, PHA's focus on the integration of behavior change, sustainability and collaboration techniques for clients seeking process improvement is resulting in new clients and additional work for existing ones.

Process Improvement

- PHA is creating an army of healthcare improvers through **Lean First**, a program created last year to build lean capability in organizations, and to ensure that improvements are sustained and continue to be refined. Nearly 250 clinicians and staff from client organizations have entered the program thus far, with 52 clients completing a **Rapid Improvement Event (RIE)**.
- RIEs are creating real and sustained improvements in clinical quality, access and revenue for both hospitals and healthcare-related organizations. One such event involved the Indiana State Department of Health, where PHA lean experts took Division of Environmental Public Health employees through an RIE to help them meet new, set timelines for commercial onsite sewage system plan reviews and thus avoid public health problems. Four Lean First-participating hospitals have transitioned from conducting RIEs to initiating **Value Stream Management** in areas such as revenue cycle, the emergency department and ambulatory care. PHA is training Indiana Critical Access and Rural Hospitals via Indiana State Office of Rural Health funding about value streams in anticipation of an August 17th "Walking Along the Value Stream" event in which they will present their project results.

**NOW WE WORK AS A TEAM, WITH
SHORT, DAILY HUDDLES IN FRONT
OF OUR PROJECT TRACKING
BOARD DURING WHICH WE
REVIEW THE STATUS AND
TRACKING OF EACH PROJECT.**

— ISDH Division Director Mike Mettler

- The Lean First **Online Community of Practice** continues to expand, up from 173 members/20 organizations to 229 members/23 organizations.
- Through PHA's ongoing work with small practices in rural Oregon, the lean services team is gaining insights and understanding in how to deploy lean coaching and training in extremely remote locations.

Health IT Security

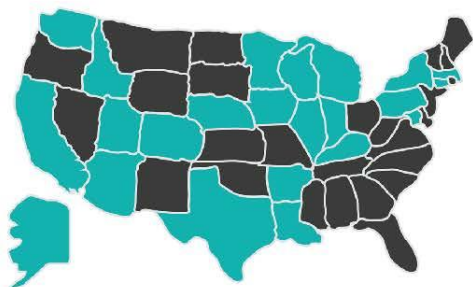
- PHA anticipates another 175+ Security Risk Assessments (SRAs) this year, spanning more than 500 unique healthcare organizations. In addition to SRAs, the Health IT Team has developed several additional assessments such as External Vulnerability Assessments (EVAs); Technology Assessments; and Payment

Appendix B

REMEDI Central

REMEDIAL

CENTRAL



2009 **2** ONE STATE 2016 **279** 23 STATES

COMPLIANCE **96,386,852**
INFUSIONS
81.8% AVG.

ALARMS **28,270,612**
ALERTS ((-))
DURING PROGRAMMING

LIBRARIES **23** **HOSPITALS**
IN 1st MONTH
271 COMPARISONS
74,382 ENTRIES
8,209 distinct drug names



Regenstrief National Center for Medical Device Informatics (REMEDI)

2009 Medication errors related to infusion therapy top the list for adverse events occurring in hospitals. To promote and improve patient safety, Regenstrief Center for Healthcare Engineering at Purdue University founds Infusion Pump Informatics as an **evidence-based community of practice**



2009 Begins **tracking alarms** generated when medical personnel program "smart pumps" (i.e. infusion pumps programmed with Drug Error Reduction Software) outside allowable limits



2013 Begins **tracking the activation** of "smart pump" technology on infusion pumps. Do clinicians turn it on?



2015 Expands scope to form **informatics-based communities of practice** around additional medical devices



2016 Forms **REMEDI Central**, an online site for medical device data, benchmarking, analysis and research results



2016 Creates a **Drug Limit Library**, which acts as a repository for concentrations and soft/hard maximums/minimums for infused drugs; and introduces a standard profile and drug mapping for easier comparisons



Appendix C

Faculty Position Advertisement



Faculty Positions in Healthcare Engineering

Healthcare engineering considers health care as a set of complex systems, and applies and innovates engineering design and analysis principles to these systems in order to improve patient experiences, reduce costs, and improve the health and wellness of populations. This includes interactions with healthcare providers, employers, community organizations, and state, federal, and international health departments.

Description: We are seeking three highly qualified individuals with expertise in healthcare engineering. Areas of emphasis include medical decision making, healthcare operations and logistics, point of care technologies, remote monitoring, capacity and demand management, service science, machine learning and inference, health analytics, population and rural health, behavior and incentives modeling, human factors in healthcare, health policy, implementation science, and high performance computing applied to health informatics. New faculty are sought to build strong research programs working in collaboration with Purdue's Regenstrief Center for Healthcare Engineering (RCHE), which is located in Discovery Park, Purdue's high-impact, interdisciplinary research complex. The goal is preeminence in healthcare engineering research combined with transformative impact on healthcare delivery and community engagement for improving healthcare and wellness outcomes.

Diversity: Purdue University is committed to the development of a multicultural environment. We value the input of multiple viewpoints and perspectives across the university; our goal is to create an academic community that is rich with cultural, social, and intellectual diversity.

Qualifications: Candidates must hold a Ph.D. in biomedical engineering, computer engineering, computer science, electrical engineering, industrial engineering, mechanical engineering, or a related field. The focus is on the assistant professor level, but outstanding individuals at all levels of experience will be considered. New faculty members will be expected to develop strong, externally-funded research programs, develop and teach innovative curricula, and help advance the frontiers of knowledge with current and future faculty affiliated with RCHE.

Applications should include a letter of interest, CV, academic transcripts, statements of approach, vision for research and teaching, and names and contact information for five references. Please go to <https://engineering.purdue.edu/Engt/InfoFor/Employment> to apply. If you cannot submit your application at this website, please contact Ms. Lisa Stacey at stacey1@purdue.edu. Questions regarding the position may be addressed to the chair of the search committee, Professor Jane Doe – jdoe@purdue.edu. A background check will be required for employment in this position.

Review of applications begins October 1, 2017, and continues until the positions are filled.

*Purdue University is an equal opportunity /equal access /affirmative action employer
fully committed to achieving a diverse workforce.*